

May 24, 2007

TO: D. Morris

FROM: S. Chhan

SUBJECT: PHX 34M Additional Coverage Study

The Resource Allocation Planning Service (RAPS) has completed a study to analyze the supportability for Phoenix Mission on the DSN 34-Meter subnet and any impacts to other DSN users if Phoenix increases requirements on the DSN 34-Meter subnet. The Phoenix Mission requested continuous coverage on the 34-M Subnet which is equivalent to 7 (8Hour) passes per week at each complex from week 43 through week 48 in 2007 (DOY 300 through DOY 330). This additional requirement from the 34M coverage is to better characterize the Phoenix spacecraft around the time of its turn to the outer cruise attitude and the subsequent passive thruster characterization activities.

### **Assumptions**

The analysis combined the downtimes of DSS-45 in weeks 35-47 for the 200 watts S-band uplink and antenna controller replacement. Additionally, DSS-65 has a scheduled downtime from weeks 44-49 for the 200 watts S-band uplink implementation. An assumption was made to Goldstone Complex to be able to support the increased requirements from Phoenix since there are no antenna downtime scheduled from weeks 43-48, and Goldstone Complex has full capacity of resources.

### **Summary of Results**

An analysis on the supportability of Phoenix on the 34-Meter Beam Wave Guides (34M) at both complex at Canberra and Madrid was determined by adding 7 (8 Hour) passes at DSS-34 and the same requirements at DSS-55 to determine the supportability from the 34-M subnet at Canberra. The second results of adding 7 (8 Hour) passes on DSS-54 and the same requirements on DSS-55 determined the supportability from the 34-M subnet at Madrid.

The overall supportability for Phoenix at Canberra resulted below 50% for the entire duration in weeks 43-48 when adding additional requirements to DSS-34 and especially with DSS-45 scheduled downtime for Antenna Drive Cabinet and Antenna Controller Replacement in weeks 35-47. There are significant drop in supportability from the original requested requirements throughout the entire duration in weeks 43-48 after adding 7 (8Hr) passes per week on DSS-34 and the same addition on DSS-55. The results indicate that Canberra will only be able to support about 50% or less of the required additional requested times. Please see figure 1 and figure 2 below for comparison of the original requested times versus the additional time requested on DSS-34 and DSS-55.

Due to the fact that DSS-34 is the only 34B1 antenna available in Canberra during the requested addition of times, an analysis of DSS-43 (70-Meter) as an alternative to support the additional requirements of continuous support for Phoenix was performed. The results indicate that DSS-43 is unable to support Phoenix continuous support without impact, however the supportable percentage is better than using only DSS-34 alone at Canberra. Please see figure1 and figure 3

below for supportable percentage comparison with the original requested times versus the result on DSS-43 and DSS-55 after additional requested support.

The overall supportability for Phoenix at Madrid is possible when adding additional requirements to DSS-54 even though DSS-65 has a scheduled downtime from weeks 44-49. Although the additional requirements do have low supportable percentage below 75% for the entire duration in weeks 43-48. The supportability percentage dropped for the entire duration from weeks 43-48 for the 34B1 (DSS-54) and also for the 34B2 (DSS-55) after adding 7 (8Hr) passes per week on DSS-54 and the same addition on DSS-55. The alternative to support Phoenix additional request is to utilize or shift the load from DSS-54 to DSS-55 to account for the low supportable percentage throughout the entire duration from weeks 43-48. Please see figure 1 and figure 4 below for comparison of results.

Figure 1: DSN Supportability Percentage for the Original PHX Requirements of 3 (8Hr) passes per week on the 34-Meter Subnet (34B1 & 34B2) for weeks 43-48, 2007.

		Week					
Mission (User)	Subnet	43	44	45	46	47	48
PHX	All	92%	100%	100%	100%	100%	100%
PHX Cruise	34B1	94%	100%	100%	100%	100%	100%
PHX Cruise	34B2	94%	100%	100%	100%	100%	100%

Figure 2: DSN Supportability Percentage for PHX after addition of 7 (8Hr) passes per week on DSS-34 (34B1) and 7 (8Hr) passes on DSS-55 (34B2) in weeks 43-48, 2007.

			Week					
Antenna	User	Subnet	43	44	45	46	47	48
DSS-34	PHX	34B1	44%	49%	40%	52%	53%	69%
DSS-55	PHX	34B2	80%	93%	92%	90%	95%	96%

Figure 3: DSN Supportability Percentage for PHX after addition of 7 (8Hr) passes per week on DSS-43 (70M) and 7 (8Hr) passes on DSS-55 (34B2) in weeks 43-48, 2007.

			Week					
Antenna	User	Subnet	43	44	45	46	47	48
DSS-43	PHX	70M	87%	69%	60%	58%	71%	58%
DSS-55	PHX	34B2	80%	93%	92%	90%	95%	96%

Figure 4: DSN Supportability Percentage for PHX after addition of 7 (8Hr) passes per week on DSS-54 (34B1) and 7 (8Hr) passes on DSS-55 (34B2) in weeks 43-48, 2007.

			Week					
Antenna	User	Subnet	43	44	45	46	47	48
DSS-54	PHX	34B1	75%	63%	61%	68%	62%	74%
DSS-55	PHX	34B2	80%	93%	92%	90%	95%	96%

## Analysis of Results

Analysis was accomplished by running forecasts for weeks 22-52 for year 2007 because this report was performed in week 21 and the intention was to determine whether the additional

requirements by Phoenix in weeks 43-48 have any impacts on DSN users and subnets. Results only focus in weeks 43-48 on the supportability percentage at Canberra and Madrid 34-M subnet. Prior to running the forecasts, the Phoenix User Loading Profile (ULP) was amended to include 7 passes per week with 8 hours per pass on DSS-34 and DSS-55, similarly for DSS-54 and DSS-55 separately. This additional passes on DSS-34, DSS-54, DSS-55 resulted in low supportability for the entire duration in weeks 43-48. Also the analysis of DSS-43 was to indicate if there is an alternative for supportability if DSS-34 resulted in low supportable percentage. The DSN Antenna Downtime Status and Forecast was also used to show the scheduled downtimes and any critical events that may affect this study and its subject. In particular there are two downtimes at DSS-45 (weeks 35-47) and DSS-65 (weeks 44-50) which did have major impact on both the Canberra and Madrid 34-M subnet for the entire duration of the study focus in weeks 43-48.

## **Conclusion**

Forecast results indicate that additional requirements from Phoenix on the 34-Meter subnet appear to have low supportable percentage and may have an impact on the DSN users and other subnets for the entire duration in weeks 43 through 48. Canberra has the lowest supportable percentage below 50% average for DSS-34, moreover, DSS-43 can slightly improve the supportability if some of the requirements are shifted from DSS-34 to this 70-Meter antenna. For Madrid, the supportability looks promising as the low supportability percentage on DSS-54 could be resolved by offloading or negotiating the 34-M requirements to other subnets such as the DSS-55 or the 70-Meter subnet. Another alternative recommendation is to reduce the continuous support request from all DSN 34-Meter subnets from 24 hours to 20 hours per day may improve the supportability percentage on certain weeks with low supportability percentage. The other issues that may arise are from new requirements from other DSN users in the near future.

The Results Of This Study Are Subject To Change, In That Network Loading Changes, As Requirements For Planned Missions Are Input And Updated And Periods Of Antenna Downtime Are Identified.